Appl. No.: 10/806,501
Amdt. dated 12/22/2004
Amdt. responsive to Office action mailed 09/14/2004

<u>Amendments to the Claims</u>:

1. (Currently Amended) A computer system for controlling a non-linear physical process, the computer system comprising:

a linear controller connected to receive a command signal for control of the non-linear physical process and an output signal from [[the output of]] the non-linear physical process, the linear controller generating a control signal based on the command signal, the output signal, and a fixed linear model for the process; and

a neural network connected to receive the control signal from the linear controller and the output signal from the non-linear physical process, the neural network receiving the control signal as an input and using the output signal to modify the connection weights of the neural network <u>on-line as the neural network and linear controller are used to control the non-linear physical process</u>, the neural network generating a modified control signal <u>that combines with the control signal output from</u> [[supplied to]] the linear controller [[to iterate or approximate a fixed point solution used]] to control the non-linear physical process to correct for errors inherent in modeling the physical process using the fixed linear model.

2. (Original) A computer system as claimed in Claim 1 wherein the linear controller is a proportional-derivative (PD) controller.

3. (Original) A computer system as claimed in Claim 1 wherein the linear controller is a proportional-integral-derivative (PID) controller.

4. (Original) A computer system as claimed in Claim 1 wherein the neural network is trained entirely on-line based on the output signal.

5. (Currently Amended) A computer system as claimed in Claim 1 wherein the linear controller comprises a plurality of attitude controllers and the neural network comprises a

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plurality of neural network subunits, the attitude controllers and neural network subunits [[controlling]] generating respective degrees of freedom of the modified control signal.

6. (Original) A computer system as claimed in Claim 1 further comprising:

a command transformation unit connected to receive a body angular rate signal, and generating the command signal based on the body angular rate signal.

7. (Original) A computer system as claimed in Claim 6 wherein the command signal includes the first derivatives of commanded roll, pitch, and yaw attitudes of an aircraft.

8. (Original) A computer system as claimed in Claim 7 further comprising:

an integrator connected to receive the first derivatives of the commanded roll, pitch, and yaw attitude signals, and integrating the first derivatives of the commanded roll, pitch, and yaw attitude signals to generate the commanded roll, pitch, and yaw signals, the integrator connected to supply the commanded roll, pitch, and yaw signals to the linear controller as a part of the command signal.

9. (Original) A computer system as claimed in Claim 6 further comprising:

a command augmentation unit connected to receive roll rate and acceleration command signals from a pilot, the command augmentation unit generating the body angular rate signal based on the roll rate and acceleration command signals from the pilot.

10. (Original) A computer system as claimed in Claim 9 wherein the command augmentation unit further generates the body angular rate signal based on side slip in addition to the roll rate and acceleration command signals from the pilot.

11. (Currently Amended) A computer system as claimed in Claim 1 further comprising:

an inverse function unit connected to receive **the combined** [[modified]] control signal **and modified control signal,** the inverse function unit generating [[a]] **an actuator**

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control signal for controlling the non-linear physical process based on the [[modified]] **combined** control signal **and modified control signal**.

12. (Original) A computer system as claimed in Claim 1 further comprising:

an inertial measurement unit (IMU) connected to sense the output of the non-linear physical process, the IMU generating the output signal based on the output of the non-linear physical process.

13. (Original) A computer system as claimed in Claim 1 wherein the non-linear physical process relates to flight control of an aircraft.

14. (Currently Amended) A computer system comprising:

a proportional-derivative (PD) linear controller connected to receive a command signal for a degree of freedom of a controlled physical process, and a measured output signal for the degree of freedom of the output of the controlled physical process, and generating a linear control signal based on the command signal and the measured output signal;

a filter connected to receive the command signal for the degree of freedom, and **differentiating** [[generating a derivative of]] the command signal to generate a differentiated command signal;

a node connected to receive the linear control signal from the PD linear controller, [[and]] the differentiated command signal from the filter, **and a modified pseudo control signal,** the node generating a pseudo control signal based on the linear control signal, [[and]] the differentiated command signal, **and the modified pseudo control signal**; and

a neural network connected to receive the command signal, the measured output signal, and the pseudo control signal from the node, the neural network generating a modified pseudo-control signal based on the command signal, measured output signal, and the pseudo control signal, **the neural network receiving at least the control signal as an input and using the measured output signal to modify the connection weights of the neural network on-line as the neural network and PD linear controller are used to control the physical process,** the

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neural network connected to supply the modified pseudo control signal to the node for use in controlling the [[non-linear]] physical process to augment the linear control provided by the linear controller to account for [[the non-linear nature]] **nonlinearity** of the physical process.

15. (Currently Amended) A computer system as claimed in claim 14 further comprising:

an inversion function unit coupled to receive the command signal, the measured output signal, [[and]] the pseudo control signal, **and the modified pseudo control signal combined by** [[from]] the node, the inversion function unit generating a control signal for controlling the [[non-linear]] physical process based on the command signal, the measured output signal, [[and]] the pseudo control signal, **and the modified pseudo control signal combined by the node.**

16 - 19. (Canceled)

20. (New) The computer system as claimed in Claim 1 wherein the linear controller and the neural network are used to control the non-linear physical process using a moving surface controlled by a hydraulic actuator based on the signals generated by the linear controller and the neural network.

21. (New) The computer system as claimed in Claim 1 wherein the linear controller and the neural network are used to control the non-linear physical process using a moving surface controlled by an electrical actuator based on the signals generated by the linear controller and the neural network.

22. (New) The computer system as claimed in Claim 1 wherein the linear controller and the neural network are used to control the non-linear physical process by controlling airflow over the surface of an aircraft using synthetic jets based on the signals generated by the linear controller and the neural network.

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23. (New) The computer system as claimed in Claim 14 wherein the PD linear controller and the neural network are used to control the physical process using a moving surface controlled by a hydraulic actuator based on the signals generated by the PD linear controller and the neural network and combined by the node.

24. (New) The computer system as claimed in Claim 14 wherein the PD linear controller and the neural network are used to control the physical process using a moving surface controlled by an electrical actuator based on the signals generated by the PD linear controller and the neural network and combined by the node.

25. (New) The computer system as claimed in Claim 14 wherein the PD linear controller and the neural network are used to control the physical process by controlling airflow over the surface of an aircraft using synthetic jets based on the signals generated by the PD linear controller and the neural network and combined by the node.

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